CLAIMS

What is claimed is:

1. A method for imaging, on an aircraft instrumentation display system bit-mapped display formed of a multiplicity of individually-addressable pixels at locations through the display and actuatable to create images on the display, aircraft flight information based on data that is input to the display system for presentation on the display, comprising the steps of:

(A) generating, by a rendering computer operable for graphically rendering the aircraft flight information on the display for use by flight crew of the aircraft in operating the aircraft and for receiving the input data, from the received input data anti-aliased graphical current imaging data for selectively actuating the multiplicity of display pixels with the generated anti-aliased graphical current imaging data to create on the bit-mapped display the graphically-depicted flight information comprising a dynamically-changeable graphically-depicted flight parameter, the flight parameter being graphically depicted by rendering computer generated current imaging data visibly imaged at a predetermined location on the display by selective actuation of a subject plurality of the pixels of said multiplicity of display pixels to visually form the graphical flight parameter depiction at the display location;

(B) generating, by a comparator processor operable for receiving the input data, from the received input data current comparison imaging data for comparison by the comparator processor with selected parts of the rendering computer generated current imaging data for the flight parameter to thereby validate the current imaging data

that is generated by the rendering computer for graphically rendering the flight information on the display, said current comparison imaging data corresponding to the rendering computer generated current imaging data which is for use in actuating only a current predetermined subset of said subject plurality of the pixels of said multiplicity of display pixels for visibly imaging the flight parameter at the predetermined location, so that the current comparison imaging data comprises current imaging data for actuating only said current predetermined subset of the said subject plurality of pixels;

(C) comparing, by the comparator processor, said current comparison imaging data to the corresponding rendering computer generated current imaging data for actuating the current predetermined subset of said subject plurality of pixels for the flight parameter to thereby evaluate the graphically rendered aircraft flight information generated by the rendering computer for presentation on the display by checking, from among all of the current imaging data generated by the rendering computer, only a predetermined portion of the rendering computer generated current imaging data comprising a meaningful plurality of individual data values of the rendering computer generated current imaging data for actuating the current predetermined subset of said subject plurality of pixels;

(D) selecting a new predetermined subset of said subject plurality of pixels for the flight parameter, said new predetermined subset of said subject plurality of pixels being different from said current predetermined subset of said subject plurality of pixels; and

(E) repeating said steps (A), (B), (C) and (D) at successive predetermined time intervals to periodically refresh the graphically-presented flight information on the display with an updated presentation of the dynamically-changeable graphically-depicted flight parameter and to compare the comparison imaging data corresponding to the new predetermined subset of said subject plurality of pixels to the corresponding rendering computer generated current imaging data for actuating the new predetermined subset of said subject plurality of pixels for the updated presentation of the flight parameter on the display.

2. A method in accordance with claim 1, further comprising the steps of:

receiving and buffering, by an input/output processor, the input data; and

transferring the buffered input data to the rendering computer and to the comparator processor.

3. A method in accordance with claim 2, wherein said transferring step comprises transferring the buffered input data to the rendering computer and to the comparator processor along a bus connecting the input/output processor, the rendering computer and the comparator processor.

4. A method in accordance with claim 1, wherein the current comparison imaging data comprises not-anti-aliased imaging data, and wherein said comparing step comprises comparing the not-anti-aliased current comparison imaging data to the corresponding rendering computer generated anti-aliased current imaging

data in a manner so as to enable, by said comparison, validation of the current imaging data generated by the rendering computer.

5. A method in accordance with claim 4, wherein each of said rendering computer generated current imaging data and said current comparison imaging data comprises color information presented as a plurality of data bits, and wherein said comparing step further comprises comparing a predetermined number of the plural data bits of said current comparison imaging data and of said corresponding rendering computer generated current imaging data for validating the current imaging data generated by said rendering computer.

6. A method in accordance with claim 4, wherein each of said rendering computer generated current imaging data and said current comparison imaging data comprises color information presented as a plurality of data bits, and wherein said comparing step further comprises comparing a predetermined number of the most-significant bits of said plural data bits of said current comparison imaging data and of said corresponding rendering computer generated current imaging data for validating the current imaging data generated by said rendering computer.

7. A method in accordance with claim 6, wherein the color information is presented as a data byte comprising 8 data bits, and wherein said predetermined number comprises two.

8. A method in accordance with claim 4, wherein each of said rendering computer generated current imaging data and said current comparison imaging data comprises color information presented as a plurality of data bits for each of red, green and blue colors, and wherein said comparing step further comprises comparing, for each of the colors red, green and blue, a predetermined number of the most-significant bits of said plural data bits of said current comparison imaging data and of said corresponding rendering computer generated current imaging data for validating the current imaging data generated by said rendering computer.

9. A method in accordance with claim 1, wherein the rendering computer comprises a commercial, general purpose, motherboard-based personal computer having a microprocessor, data storage and a graphics processor, and wherein the comparator processor comprises a custom-designed apparatus having a microprocessor, data storage and a comparator and is specially designed and configured for said generating of the current comparison imaging data and for said comparing of the current comparison imaging data to the corresponding rendering computer generated current imaging data.

10. A method in accordance with claim 1, further comprising the step of receiving from the rendering computer, in a buffer of the comparator processor, the rendering computer generated current imaging data, and wherein said comparing step comprises comparing the current comparison imaging data generated by the

comparator processor to the corresponding rendering computer generated current imaging data from the buffer.

11. A method in accordance with claim 10, further comprising the step of storing, in a FIFO stack of the comparator processor, the current comparison imaging data generated by the comparator processor, and wherein said comparing step further comprises serially providing the stored current comparison imaging data from the FIFO stack for comparison of the serially-provided current comparison imaging data with the corresponding rendering computer generated current imaging data from the buffer.

12. A method in accordance with claim 11, wherein said comparing step further comprises comparing an address of a display pixel to be actuated by the corresponding rendering computer generated current imaging data in the buffer to a display address of current comparison imaging data stored in the FIFO stack, and comparing the current comparison imaging data stored in the FIFO stack to the rendering computer generated current imaging data in the buffer in response to a successful comparison of the display pixel address and the display address.

13. A method in accordance with claim 12, wherein each of said rendering computer generated current imaging data and said current comparison imaging data comprises color information presented as a plurality of data bits, and wherein said step of comparing the current comparison imaging data stored in the FIFO stack to the rendering computer generated current imaging data in the buffer in response to a successful comparison of the display pixel address and the display

address comprises comparing a predetermined number of the plural data bits of said current comparison imaging data and of said corresponding rendering computer generated current imaging data for validating the imaging data generated by said rendering computer.

14. A method in accordance with claim 10, further comprising the step of transmitting the rendering computer generated current imaging data from the buffer to the display, for graphically rendering the aircraft flight information on the display for use by the flight crew of the aircraft, after said step of comparing the current comparison imaging data generated by the comparator processor to the corresponding rendering computer generated current imaging data from the buffer.

15. A method in accordance with claim 10, further comprising the step of transmitting the rendering computer generated current imaging data from the buffer to the display, for graphically rendering the flight parameter on the display for use by the flight crew of the aircraft, after said step of comparing the current comparison imaging data generated by the comparator processor to the corresponding rendering computer generated current imaging data from said buffer for said flight parameter.

16. A method in accordance with claim 1, wherein said plural parameter is represented on the display by a graphically-presented elongated pointer that rotates about a point defined at one end of the pointer, and wherein the current comparison imaging data for said flight parameter comprises the predetermined subset

of pixels for imaging discrete locations along the length of the graphically-presented pointer.

17. A method in accordance with claim 1, wherein said flight parameter is represented on the display by a graphically-presented alphanumeric character, and wherein the current comparison imaging data for said flight parameter comprises the predetermined subset of pixels for imaging discrete locations on the graphically-presented alphanumeric character.

18. A method in accordance with claim 1, further comprising the step of generating an error indication in response to a predeterminately unsuccessful comparison of the current comparison imaging data and the corresponding rendering computer generated current imaging data to thereby inform the flight crew of a validation failure of the rendering computer generated imaging data.

19. A method in accordance with claim 18, wherein said step of generating an error indication comprises graphically presenting on the display a visual error indication.

20. A method in accordance with claim 1, wherein said selecting step (D) comprises selecting the new predetermined subset of said subject plurality of pixels for the flight parameter in which at least one of the pixels of said new predetermined subset of said subject plurality of pixels is different from the pixels of said current predetermined subset of said subject plurality of pixels.

21. An aircraft instrumentation display system for imaging, repeatedly at predetermined image-updating refresh intervals, on a bit-mapped display formed of a multiplicity of individually-addressable pixels at locations throughout the display and actuatable to create images on the display, aircraft flight information based on dynamically-changeable data that is input to the display system, comprising:

a rendering computer operable for graphically rendering the aircraft flight information on the display for use by flight crew of the aircraft in operating the aircraft and for receiving the dynamically-changeable input data and generating from the received input data, at each of said refresh intervals, anti-aliased graphical imaging data for selectively actuating the multiplicity of display pixels with the generated anti-aliased graphical imaging data to create on the bit-mapped display the graphically-depicted flight information comprising a dynamically-changeable graphically-depicted flight parameter, said flight parameter being graphically depicted at each said refresh interval by rendering computer generated imaging data visibly imaged at a predetermined location on the display by selective actuation of a subject plurality of the pixels of said multiplicity of display pixels to visually form the graphical flight parameter depiction at the display location; and

a comparator processor for receiving the dynamically-changeable input data and generating from the received input data, at each of said refresh intervals, comparison imaging data for comparison by said comparator processor with selected parts of the rendering computer generated imaging data for the flight parameter at said each refresh interval to thereby validate the imaging data that is generated by the

rendering computer at said each refresh interval for graphically rendering the flight information on the display, said comparison imaging data at said each refresh interval corresponding to the rendering computer generated imaging data at said each refresh interval which is for use in actuating at said each refresh interval only a predetermined subset of said subject plurality of the pixels of said multiplicity of display pixels for visibly imaging at said each refresh interval the flight parameter at the predetermined location, so that the comparison imaging data at said each refresh interval comprises imaging data for actuating only said predetermined subset at said each refresh interval of the said subject plurality of pixels and said predetermined subset of the subject plurality of pixels being different for each successive refresh interval relative to the predetermined subset of the subject plurality of pixels for each immediately preceding refresh interval, and said comparator processor being further operable for comparing at each said refresh interval said comparison imaging data at said each refresh interval to the corresponding rendering computer generated imaging data at said each refresh interval for actuating the predetermined subset at the said each refresh interval of said subject plurality of pixels for the flight parameter to thereby evaluate at each said refresh interval the graphically rendered aircraft flight information generated by the rendering computer at said each refresh interval for presentation on the display by checking, from among all of the imaging data generated by the rendering computer at said each refresh interval, only a predetermined portion of the rendering computer generated imaging data comprising a meaningful plurality of individual data values of the rendering

computer generated imaging data for actuating at said each refresh interval the predetermined subset at said each refresh interval of said subject plurality of pixels.

22. An aircraft instrumentation display system in accordance with claim 21, further comprising an input/output processor for receiving and buffering the input data for transfer of the buffered sensor data to the rendering computer and to the comparator processor.

23. An aircraft instrumentation display system in accordance with claim 22, further comprising a data transfer bus connecting the rendering computer, the comparator processor and the input/output processor.

24. An aircraft instrumentation display system in accordance with claim 21, wherein the comparison imaging data generated by the comparator processor at each said refresh interval is not anti-aliased, and wherein the comparator processor comprises means for comparing the not-anti-aliased comparison imaging data at each said refresh interval to the corresponding rendering computer generated anti-aliased imaging data at said each refresh interval in a manner so as to enable, by said comparison, validation of the imaging data generated by said rendering computer at said each refresh interval.

25. An aircraft instrumentation display system in accordance with claim 24, wherein each of said rendering computer generated imaging data and said comparison imaging data comprises color information presented as a plurality of data

bits, and wherein said comparing means comprises a comparator for comparing a predetermined number of the plural data bits of said comparison imaging data at each said refresh interval and of said corresponding rendering computer generated imaging data at said each refresh interval for validating the imaging data generated by said rendering computer at said each refresh interval.

26. An aircraft instrumentation display system in accordance with claim 24, wherein each of said rendering computer generated imaging data and said comparison imaging data comprises color information presented as a plurality of data bits, and wherein said comparing means comprises a comparator for comparing a predetermined number of the most-significant bits of said plural data bits of said comparison imaging data and of said corresponding rendering computer generated imaging data for validating the imaging data generated by said rendering computer.

27. An aircraft instrumentation display system in accordance with claim 26, wherein the color information is presented as a data byte comprising 8 data bits, and wherein said predetermined number comprises two.

28. An aircraft instrumentation display system in accordance with claim 24, wherein each of said rendering computer generated imaging data and said comparison imaging data comprises color information presented as a plurality of data bits for each of red, green and blue colors, and wherein said comparing means comprises a comparator for comparing, for each of the colors red, green and blue, a predetermined number of the most-significant bits of said plural data bits of said

comparison imaging data and of said corresponding rendering computer generated imaging data for validating the imaging data generated by said rendering computer.

29. An aircraft instrumentation display system in accordance with claim 21, wherein said rendering computer comprises a commercial, general purpose, motherboard-based personal computer having a microprocessor, data storage and a graphics processor, and wherein said comparator processor comprises a custom-designed apparatus having a microprocessor, data storage and a comparator and is specially designed and configured for generating the comparison imaging data and for comparing the comparison imaging data to the corresponding rendering computer generated imaging data.

30. An aircraft instrumentation display system in accordance with claim 21, wherein said comparator processor comprises a buffer for receiving from the rendering computer the rendering computer generated imaging data at said each refresh interval, and a comparator array for comparing the comparison imaging data generated by the comparator processor at said each refresh interval to the corresponding rendering computer generated imaging data at said each refresh interval from said buffer.

31. An aircraft instrumentation display system in accordance with claim 30, wherein said comparator processor further comprises a FIFO stack for receiving and storing the comparison imaging data generated by the comparator processor and for serially providing the stored comparison imaging data from the FIFO stack to said

comparator array for comparison of the serially provided comparison imaging data with the corresponding rendering computer generated imaging data from said buffer.

32. An aircraft instrumentation display system in accordance with claim 31, wherein said comparator array comprises a first comparator for comparing an address of a display pixel to be actuated by the corresponding rendering computer generated imaging data in said buffer to a display address of comparison imaging data stored in said FIFO stack, and a second comparator for comparing the comparison imaging data stored in said FIFO stack to the rendering computer generated imaging data in said buffer when said first comparator identifies a successful comparison of said display pixel address and said display address.

33. An aircraft instrumentation display system in accordance with claim 32, wherein each of said rendering computer generated imaging data and said comparison imaging data comprises color information presented as a plurality of data bits, and wherein said second comparator compares a predetermined number of the plural data bits of said comparison imaging data and of said corresponding rendering computer generated imaging data for validating the imaging data generated by said rendering computer.

34. An aircraft instrumentation display system in accordance with claim 30, wherein said comparator processor further comprises a video transmitter for transmitting the rendering computer generated imaging data from said buffer to the display, for graphically rendering the aircraft flight information on the display for use by

the flight crew of the aircraft, after said comparing by the comparator array of the comparison imaging data generated by the comparator processor to the corresponding rendering computer generated imaging data from said buffer.

35. An aircraft instrumentation display system in accordance with claim 30, wherein said comparator processor further comprises a video transmitter for transmitting the rendering computer generated imaging data from said buffer to the display, for graphically rendering the flight parameter on the display for use by the flight crew of the aircraft, after said comparing by the comparator array of the comparison imaging data generated by the comparator processor to the corresponding rendering computer generated imaging data from said buffer for said flight parameter.

36. An aircraft instrumentation display system in accordance with claim 21, wherein said flight parameter is represented on the display by a graphically-presented elongated pointer that rotates about a point defined at one end of the pointer, and wherein the comparison imaging data for said flight parameter comprises the predetermined subset of pixels for imaging selected discrete locations along the length of the graphically-presented pointer.

37. An aircraft instrumentation display system in accordance with claim 21, wherein said flight parameter is represented on the display by a graphically-presented alphanumeric character, and wherein the comparison imaging data for said flight parameter comprises the predetermined subset of pixels for imaging selected discrete locations on the graphically-presented alphanumeric character.

38. An aircraft instrumentation display system in accordance with claim 21, wherein said comparator processor further comprises means for generating an error indication to inform the flight crew of a predeterminately unsuccessful comparison by the comparator processor of the comparison imaging data and the corresponding rendering computer generated imaging data.

39. An aircraft instrumentation display system in accordance with claim 38, wherein said error indication is graphically presented on the display so as to be readily visible to the flight crew.

40. An aircraft instrumentation display system in accordance with claim 21, wherein at least one of the pixels of the predetermined subset at said each successive refresh interval of the subject plurality of pixels is different from the pixels of said predetermined subset of the subject plurality of pixels at said each immediately-preceding refresh interval.